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ABSTRACT

The Southwest Regional Laboratory Instructional Management System (IMS) Version 3, currently installed in four school districts, is described and its current status studied. Preliminary decisions and earlier evaluative tryouts are discussed, including a description of initial materials preparation, training, installation, monitoring operation, and evaluation. A brief history of IMS Versions 1 and 2 is presented to place Version 3 in perspective. Parameters are set forth to assist researchers in defining the scope of further work required to complete the development of Version 3 and address the architecture of incremental versions. (Author/SK)

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TITLE: THE SCOPE OF IMS VERSION 3

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ABSTRACT

This paper defines the SWRL Instructional Management System (IMS) Version 3, presently installed in four school districts. A brief history of IMS is presented to place Version 3 in perspective. Parameters are put forth to assist researchers in defining the scope of further work required to complete the development of Version 3 and address the architecture of incremental versions.

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## THE SCOPE OF IMS VERSION 3

### Generic Definition of IMS

IMS may be generically defined as a set of procedures and mechanisms for gathering and processing pupil data, and returning useful information to those persons responsible for some phase of pupil performance. This definition requires further consideration of its two components:

1. the communications system used for moving data through IMS; and
2. the data gathering techniques, processing requirements, output report generation, and audiences involved in the successful operation of IMS.

The first component may be bounded briefly within this section of the paper. Bounding the second requires consideration of the development history of IMS; this receives attention in the sections that follow.

A communications system (ComSys) may be defined as a set of mechanisms and procedures for inputting and storing data and returning information to appropriate audiences. While this definition may seem virtually the same as that of IMS, it should be recognized that a ComSys is a means by which data are moved and processed and does not delineate the data to be gathered or information to be provided. A ComSys comprises three basic components: input, data transmission to and from a processor, and output. Present research efforts center around the development and improvement of communications systems through the refinement of these three processes.

Three communication systems have been installed for the 1971-72 tryout. ComSys 1 involves U.S. Mail in - U.S. Mail out. ComSys 2, school mail in - school mail out. A major technological advancement is made with the installation of ComSys 3, which involves source data automation (SDA). ComSys 3 utilizes an on-site scanner for input and an on-site printer for output. This further automation greatly expands the information transmission potential without increasing the complexity of the human resources or the ad hoc information transmission contingencies for the school user.

IMS Versions 1 and 2

Version 1. SWRL's activity in computer-based instructional management can be traced back to 1965. Work with System Development Corporation (SDC) was instituted in 1966 to show the feasibility of computer managed instruction. Under subcontract for four years, SDC developed an operating instructional management system, first on the Q32 computer and later on the IBM 360/67. Researchers chose the state-adopted Ginn First Grade Reading Series as the vehicle of instructional management. During the summer of 1966, four teachers worked at SDC writing objectives and items to measure those objectives for that reading series. The tryout was conducted during school year 1966-67 in four classrooms. Data were gathered in the form of pupil responses on 8½ x 11 inch test sheets, were scanned by an IBM 1231 optical scanner, and the card output was transferred to tape for processing. Many output formats were generated by teachers, and participating school personnel were asked to assist in

the evaluation and redesign the output formats. A similar tryout was conducted in 1967-68 in four more classrooms with the pupil performance measures being the source of input and the teacher the main recipient of output reports.

Work during 1968-69 centered around transferring the programs to a third generation computer, improving file maintenance and report generating capabilities, as well as initial efforts on computer-generated instruction in mathematics. Also, a study was prepared by Collins (1969) to evaluate three hardware levels of instructional management.

IMS Version 1 operates on an IBM 360/67 computer possessing certain required characteristics. IMS Version 1 is available but not recommended for school use.

Version 2. During the 1969-70 school year, SWRL operated a second version of IMS. Teachers in 80 classrooms were asked to administer Criterion Exercises for the First Year Communication Skills Program (FYCSP), to score the exercises and to mark the outcome scores on class lists preprinted on machine-scannable forms. To initialize the process, SWRL gathered pupil names from all participating teachers, keypunched the names according to district, school, teacher, and class, stored the information on computer tape and generated a class roster for every teacher and each unit on machine-scannable forms. These forms were mailed to the teacher, who was requested to record four marks, one mark for total score on each outcome of each Criterion Exercise, for every pupil in her class taking the Criterion Exercise. The sheets were mailed to SWRL for scoring on a service center Univac 1108 computer.

Test scores were generated, evaluated and reported by the SWRL Product Integration Division. This study demonstrated the ability of SWRL to prepare, with precision, scannable answer sheets, to train teachers how to mark answer sheets, and to read teacher-marked sheets with reliability. A final report of that study is presented by Hanson (TM 5-70-01) and Hanson et al. (TM 5-70-03).

## Boundaries of IMS Version 3

IMS Version 3 may be bounded in terms of the following parameters:

- pedagogical-engineering interface
- hardware configuration
- scope of instructional systems and/or curricular programs to be managed
- system exercise

## Version 3 Pedagogy-Engineering Interface

The development of IMS Version 3 was initialized by setting forth four functions:

1. Current performance status reporting
2. File maintenance and updating
3. Diagnosis and prescription
4. Computer-generated instruction

The intent of these functions was to provide an interface between an engineering perspective of IMS and a pedagogical perspective of IMS. This interface objective demanded the integration of pedagogical and

engineering referents. Although the four functions as set forth did capably fulfill the initializing intent, as development proceeded it became patently clear that the communication base was underdefining both the scope of the version and its development operations.

The problem arises because the logic for each function as well as each of the functions itself is independent. Thus, the functions tended to be either over-interpreted, with surplus expectation the consequent, or under-interpreted, with shallow exploitation the consequent. This unfortunate condition was most evident in confusion concerning Function 1 and Function 3. The "fine print" made it clear that much information commonly termed diagnostic and prescriptive would be drawn from current performance data. This stipulation was usually overlooked, and "scores only" were assumed. Likewise, it was stipulated that Function 3 would involve algorithmic data massaging rather than simple table lookups. This stipulation also was commonly disregarded.

In sum, while the four functions set forth were useful to bound development initiation, it is clear that a better base for development completion can be set forth in terms of a pedagogy-information interface.

Pedagogy-Information Interface

Version 3 completion will provide the capability to present users with a variety of information options. These options are bounded by the following considerations:

. selection of data to be gathered

. selection and/or preparation of data gathering devices and procedures

. aggregation of data to comprise output information

. identification of audiences to receive output reports

. preparation of output formats and determination of periodicity of information reporting.

Each of these components has been analyzed and many preliminary decisions have been made. The data comprise pupil performance measures taken at a determined number of times (usually 10 or 15) in the instructional program. These measures are gathered on machine readable answer sheets. Several types of data aggregation have been programmed. The most basic is the listing of pupils by group or class, their scores on various outcomes within the test, and class and group averages by outcomes. In addition to current test results, other types of reports have been proposed: grouping suggestions, pacing projections, and suggestions for supplementary instruction.

Several audiences have been identified as central for reception of output reports. Most important are teachers, principals, curriculum supervisors, district level personnel, and parents. SWRL researchers must be considered, as well as pupils themselves. Efforts are being made to measure the impact of output formats on various audiences as well as the importance of the frequency (periodicity) of report generation.

Hardware/Software Development Configuration

The IMS hardware configuration is documented in IMS Version 3 Preliminary Planning Documentation (SWRL, 1971). Input devices for ComSys 3 include an on-site optical scanner and high-speed keyboard. A data concentrator unit (DCU) receives input from school sites, pre-processes the data received, and transmits them over telephone lines to a large central processor which contains the resident IMS software. Files are updated and reports are generated and returned to the DCU, which transmits the output to a high-speed character printer at the school location.

The completion of Version 3 will require alternative configuration trade-off analyses that are currently in progress.

Instructional Systems

It was decided to use one instructional system for Version 3 operation, the SWRL First Year Communication Skills Program (FYCSP). However, any instructional system containing certain characteristics, i.e., a bounded subject matter, operationally defined objectives, measures of learning performance, and procedures for removing identified learning deficiencies can be handled by IMS. The SWRL Learning Mastery System (LMS), which contains procedures for a teacher-operated management system, possesses the required characteristics for use in IMS. Thus, LMS Harper and Row 1, 2, and 3 as well as LMS Macmillan Bank Street First Year Reading are included in the tryout for school year 1971-72.

System Exercise

To check out and evaluate the operation of IMS in a natural school setting, Version 3 was installed in several cooperating school districts in school year 1971-72. There are five basic parts to this tryout exercise: 1) materials preparation, 2) training, 3) installation, 4) monitoring of operation, and 5) evaluation.

Materials preparation. This involved adaptation of certain materials within the instructional systems selected for use in IMS. In most cases these were modified to be machine readable. Considerations of ease of pupil use and cost of production were influential in design of forms. The adapted materials were pretested in several classrooms to assess Kindergarten pupils' ability to mark machine readable forms. The study is reported by McManus (TN 5-72-04). Analytic work in design of assessment devices for the LMS and FYCS programs is reported in TN 5-72-04.

Training. Materials and procedures were prepared to train teachers and pupils for participation in IMS. Directions for administering Criterion Exercises were prepared. All school personnel were trained by IMS and DRS staff. A report on this aspect of IMS has been prepared by Gibbs (TN 5-72-20).

Installation. The installation of IMS is considered terminated with the completion of training on a given communication system (ComSys) for inputting, processing and receipt of information on pupil performance. Again materials and procedures were developed. Clerks, teachers, administrators and district personnel were trained.

Monitoring of operation. To assure successful IMS operation through efficient use of the ComSys, SWRL researchers monitor the input, processing, and output flow, modify procedures where required, and contact individuals to correct observed malfunctions in the systems. Cooperating school personnel are also encouraged to call SWRL to clear up difficulties and to make suggestions for smoother operation.

Evaluation. Data are gathered to measure the effectiveness of ComSys operation. This information serves to make enroute changes as well as to suggest major revisions for subsequent IMS versions or later installations of the same version.

## IMS Version 3 Status

The scope of the 1971-72 tryout is depicted in Table 1. Shown are the instructional systems, the communications systems and the number of classes involved in each cell, together with cross totals. The number of pupils, listed under class in parentheses, is estimated by multiplying class number by 22, the average number of pupils per participating class. Approximately 1900 pupils in 86 classes are involved in this tryout.

Table 2 shows the number of schools participating in the tryout by ComSys and programs within ComSys.

Initial monitoring data indicate that errors in teacher operations of the system are minimal, especially after correction of "first-time" errors by means of personal conversation with teachers. Pupil marking of FYCSP sheets is of acceptable quality and consistency. Teacher affect appears high and cooperation of district-level personnel and school administration is encouraging.

Table 1

Total N for class and pupil* by ComSys and instructional system for IMS Version 3 installation, 1971-72

| Instructional System | Communication System I | II | III | Total |
|---|---|---|---|---|
| FYCSP | 3 (66) | 14 (308) | 4 (88) | 21 (462) |
| HR-1 | 12 (264) | 9 (198) | 3 (66) | 24 (528) |
| HR-2 | 10 (220) | 4 (88) | 2 (44) | 16 (352) |
| HR-3 | 5 (110) | 6 (132) | 5 (110) | 16 (352) |
| Macmillan | 0 (0) | 4 (88) | 5 (110) | 9 (198) |
| Total | 30 (660) | 37 (814) | 19 (418) | 86 (1892) |

* Pupil N in parentheses is derived by multiplying class N by 22, the average number of pupils per class

District N = 4

Table 2

Number of schools participating in IMS Tryout
by ComSys and program within ComSys

| | ComSys I | ComSys II | ComSys III | Total |
|---|---|---|---|---|
| Total Number of Schools | 5 | 9 | 1 | 15 |

| Number of Schools by Program | ComSys I | ComSys II | ComSys III | |
|---|---|---|---|---|
| FYCSP | 1 | 7 | 1 | 9 |
| HR-1 | 3 | 5 | 1 | 9 |
| HR-2 | 4 | 3 | 1 | 8 |
| HR-3 | 3 | 3 | 1 | 7 |
| MBS | 0 | 3 | 1 | 4 |
| | 11 | 21 | 5 | |

School N = 15

Column and row totals do not equal 15, since some schools are participating in more than one program within ComSys.

Completion of Version 3

IMS Version 3 will be complete when work has been finished on defined elements of the five bounded sets identified on pp. 5-6. Each set is treated in turn below.

Data to be Gathered. Input from one instructional system, in the form of assessment data, will meet requirements for this bounded set. These requirements are presently met. The SWRL Kindergarten Program and the SWRL Learning Mastery Systems satisfy the minimal requirement.

Devices and Procedures. The development and installation of one commercializable communications system with its concomitant processing capability will meet this requirement. Commercializability is defined as the willingness of a large educational market to pay for defined services. This in turn requires purveyor producibility and user manageability.

Aggregation of Data. Performance measures will be aggregated by individual, group, class, school, district, and possibly by area and state.

Audiences. Four generic commercial audiences will receive reports: instructors, supervisors, administrators, and parents. Optional alternatives will include students and researchers.

Output Formats and Periodicity. A compendium of output formats will be prepared, with options designed for each of the four user groups. The frequency of report availability may differ by groups, but each output report will utilize pupil performance information on each unit Criterion Exercise.

Target Date for Completion

Requirements for Version 3 will be met by June 1973, with the completion of the 1972-73 system exercise.

REFERENCE

Collins, Thomas F. "A Study of Computer Configurations for Instructional Management Systems," Technical Memorandum-4508, System Development Corporation, 1970.